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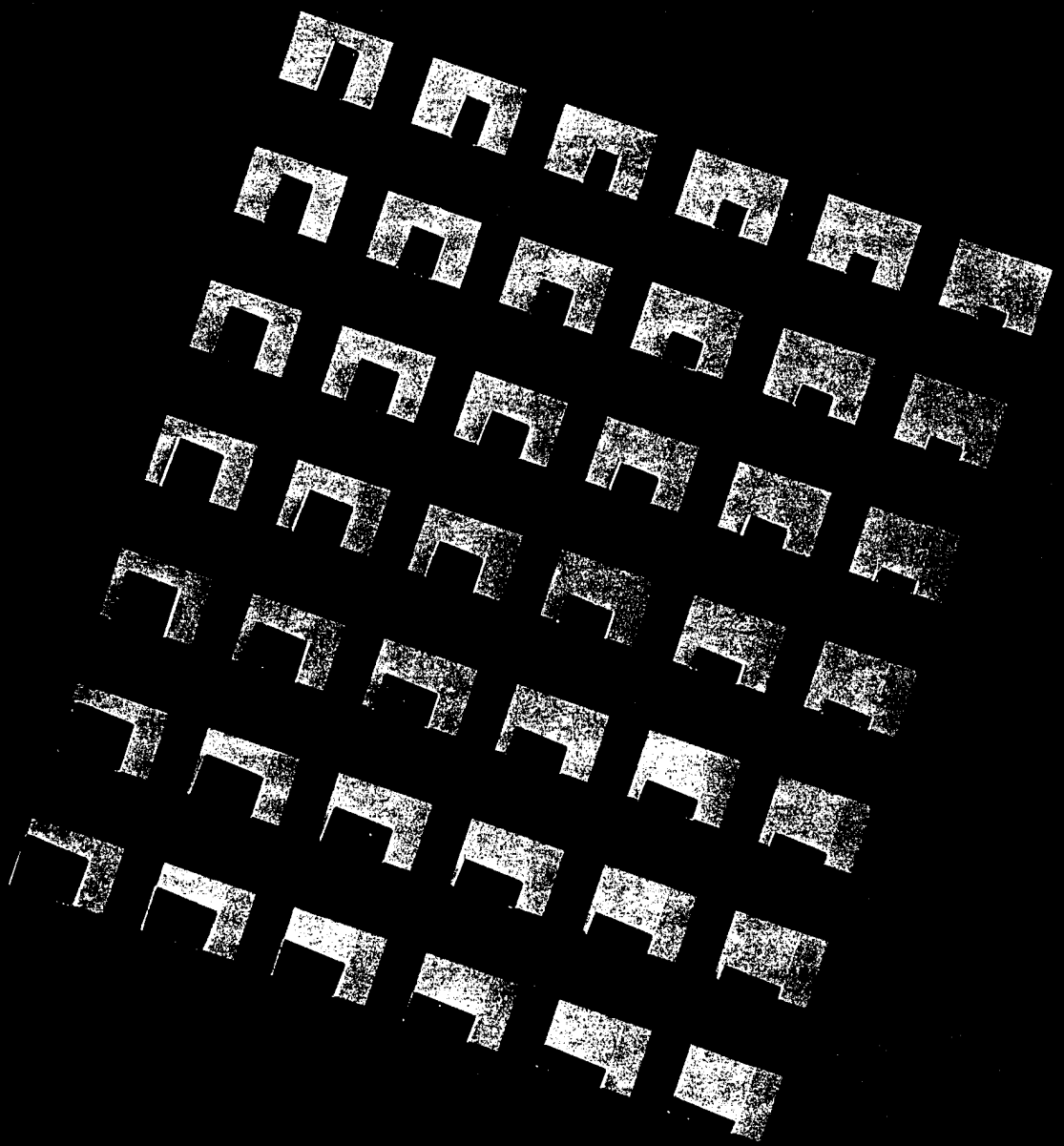
Systematic development of team training: A review of the literature

TNO Human Factors
Research Institute



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In zowel militaire als civiele organisaties worden veel taken eerder door teams dan door individuele functionarissen uitgevoerd. Ondanks het belang dat wordt gehecht aan team optreden worden slechts weinig inspanningen geleverd met betrekking tot het trainen van teams. Over het algemeen worden teams niet als zodanig getraind, met als argument dat het leren functioneren als een team het beste in de praktijk kan gebeuren. Ongevalsrapporten wijzen echter uit dat deze vorm van "team training op de werkplek" niet de meest effectieve en efficiënte manier is om teams voor te bereiden op de missies en taken die ze in de praktijk moeten uitvoeren.

Een tekortkoming in het proces van het ontwikkelen van trainingen is dat de meeste systematieken en richtlijnen primair zijn gericht op de individuele functionaris. Een systematiek specifiek gericht op teams ontbreekt vooralsnog. Het gevolg hiervan is dat opleidingsontwikkelaars van team trainingen beperkt ondersteund worden omdat de bestaande (op de individuele functionaris gerichte) systematieken onvoldoende de kenmerken van teams en team optreden verdisconteren. Dit heeft tot gevolg dat van bestaande leermiddelen die zijn ontworpen met als doel het trainen van team vaardigheden, het vaak niet duidelijk is welke onderwijskundige principes op welke manier toegepast moeten worden.

In dit rapport wordt, na de introductie in hoofdstuk 1, het begrip team optreden nader gedefinieerd (hoofdstuk 2). In hoofdstuk 3 wordt een korte omschrijving gegeven van de vier fasen van opleidingsontwikkeling, namelijk: analyse, ontwerp, implementatie en evaluatie. Aan de hand van deze algemene fasen wordt in hoofdstuk 4 een overzicht gegeven van verschillende richtlijnen voor het ontwikkelen van team trainingen zoals omschreven in de literatuur. Elk van deze richtlijnen (steeds met betrekking tot slechts een gedeelte van het totale proces van opleidingsontwikkeling, zoals b.v. het uitvoeren van een taakanalyse, het ontwikkelen van trainingsscenario's, het ontwerpen van een opleidingstraject) wordt beschreven en geëvalueerd. Op basis van deze literatuurstudie wordt geïnventariseerd welke aspecten van opleidingsontwikkeling ten behoeve van team training nog nader ingevuld moeten worden (hoofdstuk 5). Deze hebben met name betrekking op het uitvoeren van een analyse van een teamtaak, het ontwerpen van trainingsscenario's om teamleden in de gelegenheid te stellen de vereiste vaardigheden te leren en te oefenen, het toepassen van leerpsychologische en onderwijskundige principes bij het formuleren van (functionele) specificaties van geavanceerde leermiddelen, het vaststellen van de effectiviteit en efficiëntie van team trainingen, het empirisch valideren van de richtlijnen, en het integreren van de verschillende richtlijnen in één alomvattende systematiek voor het ontwikkelen van team trainingen. In hoofdstuk 6 tenslotte wordt aangegeven in welke richting het vervolgonderzoek zal worden uitgevoerd. In een veldonderzoek zal worden nagegaan door welke richtlijnen ontwikkelaars van team trainingen en instructeurs zich laten leiden. Op basis van zowel literatuur- als veldonderzoek wordt een prototype van een systematiek voor de ontwikkeling van team training vastgesteld. Voor specifieke onderdelen die onvoldoende of niet eenduidig gedefinieerd zijn, worden concrete richtlijnen geformuleerd die vervolgens empirisch getoetst zullen worden.

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SUMMARY

A major drawback in the process of developing team training systems is that most methodologies and guidelines for developing training systems are aimed at the individual trainee. A coherent methodology for developing team training systems is still lacking. Consequently, developers of team training systems must often resort to the use of recommendations and guidelines geared to the development of individual-centered training systems. However, these may be insufficient given the different nature and characteristics of teams and team performance. Related to this point is the fact that, regarding complex learning environments developed for team training, it is often not clear which, and how, instructional principles should be applied to actually train the team.

In this report, the concept of team performance is being defined (chapter 2), preceded by an introduction in the first chapter. Chapter 3 concisely describes the four phases of instructional systems development, viz. analysis, design, implementation and evaluation. Based on these generic phases, in chapter 4 an overview is presented of various guidelines for developing team training as described in the literature. These guidelines (each referring to only some of the phases of instructional systems development) are being described and evaluated. On the basis of this review of the literature an inventory has been made regarding the aspects of team training development that remain to be analyzed (chapter 5). Finally, in chapter 6, the direction of future research is indicated.

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TNO Technische Menskunde
Soesterberg

Systematisch ontwikkelen van team training: een literatuurstudie

M.P.W. van Berlo

SAMENVATTING

Een tekortkoming in het proces van het ontwikkelen van trainingen is dat de meeste systematieken en richtlijnen primair zijn gericht op de individuele functionaris. Een systematiek specifiek gericht op teams ontbreekt vooralsnog. Het gevolg hiervan is dat opleidingsontwikkelaars van team trainingen beperkt ondersteund worden omdat de bestaande (op de individuele functionaris gerichte) systematieken onvoldoende de kenmerken van teams en team optreden verdisconteren. Dit heeft tot gevolg dat van bestaande leermiddelen die zijn ontworpen met als doel het trainen van team vaardigheden, het vaak niet duidelijk is welke onderwijskundige principes op welke manier toegepast moeten worden.

In dit rapport wordt, na de introductie in hoofdstuk 1, het begrip team optreden nader gedefinieerd (hoofdstuk 2). In hoofdstuk 3 wordt een korte omschrijving gegeven van de vier fasen van opleidingsontwikkeling, namelijk: analyse, ontwerp, implementatie en evaluatie. Aan de hand van deze algemene fasen wordt in hoofdstuk 4 een overzicht gegeven van verschillende richtlijnen voor het ontwikkelen van team trainingen zoals omschreven in de literatuur. Deze richtlijnen (elk met betrekking tot slechts een gedeelte van het totale proces van opleidingsontwikkeling) worden beschreven en geëvalueerd. Op basis van deze literatuurstudie wordt geïnventariseerd welke aspecten van opleidingsontwikkeling ten behoeve van team training nog nader ingevuld moeten worden (hoofdstuk 5). In hoofdstuk 6 tenslotte wordt aangegeven in welke richting het vervolgonderzoek zal worden uitgevoerd.

1 INTRODUCTION

Technological developments have resulted in more sophisticated and complex systems in which humans have to operate. These systems are characterized by a highly dynamic and sometimes hostile environment, the varying of (often conflicting) goals, the incompleteness, uncertainty and ambiguity of information, and the involvement of teams of officers with members having different roles and responsibilities (Rouse *et al.*, 1992).

In both military and civil organizations many tasks are performed by teams rather than individual officers. A fire-brigade, a surgical team, a tank platoon, and a Stinger group are examples of such teams. Despite the acknowledgment of the importance of team performance and team training, relatively few endeavors have been undertaken to actually train teams in a systematic way. Team training is rarely being conducted as a separate training (except bridge and crew resource management) with the argument that functioning as a team can best be learned in the operational environment, and after each member is being trained for the individual tasks. Accident reports show that this 'on-the-job team training' does not seem to be the most effective and efficient way of preparing the team for its mission and tasks (Salas, Cannon-Bowers & Johnston, 1995). This process could be enhanced by carefully developed team training systems.

A major obstacle in the process of developing team training systems is that most methodologies and guidelines for developing training systems are aimed at the individual trainee (Armstrong & Reigeluth, 1991). A coherent methodology for developing team training systems is still lacking (Miller *et al.*, 1987; Guerette *et al.*, 1987). Consequently, developers of team training systems must often resort to the use of recommendations and guidelines geared to the development of individual-centered training systems. However, these may be insufficient given the different nature and characteristics of teams and team performance. Related to this point is the fact that most instructional devices are developed for training individual officer's skills. Regarding complex learning environments developed for team training, *e.g.* SIMNET (Alluisi, 1991) it is often not clear which, and how, instructional principles should be applied to actually train the team (Salas & Cannon-Bowers, in press).

In many cases, the to be trained team is presented with instruction and feedback at an ad-hoc basis, leaving the content and timing of instruction and feedback to the initiative of the instructor (Guerette *et al.*, 1987). Consequently, instructors devote much time and effort in on-line determining the most effective way of presenting information and measuring the team performance, and the most adequate way of providing feedback. This process could be more effectively and efficiently by having available a more formal and systematic methodology for developing and monitoring team training (Miller *et al.*, 1987).

More than fifteen years ago several authors have indicated the need for a systematic development of team training (Kribs, Thurmond & Marks, 1977; Rizzo, 1980; Thurmond, 1980). The development of team training systems is a complex and costly enterprise. A methodology for systematically developing team training can help to reduce these costs. It can eliminate unnecessary but costly training practices that do not contribute to the learning

of team skills. The costs associated with poor team performance in operational environments due to inadequate training, are furthermore very high.

In chapter 2 of this report the nature of team performance will be discussed. The subject of chapter 3 is a general methodology for developing training systems. In chapter 4 it is discussed to what extent guidelines are available that specifically address team training systems. This is followed by an overview of the missing links required for producing an integrated procedure for team training development (chapter 5). Finally, chapter 6 concludes with a brief overview of future research.

2 TEAM PERFORMANCE

A team consists of two or more people, with a common goal, a specific role assignment, and tasks/activities that are interdependent (Dyer, 1984). A team makes decisions in the context of a larger task, team members have specialized knowledge and skills relevant to the task and decisions, and the task conditions under which the team operates often include high workload and time pressure (Orasanu & Salas, 1993; Salas, Bowers & Cannon-Bowers, 1995). So, teams perform specific tasks in certain contexts for which they have to possess specific skills. These aspects (context, task, and skills) will be discussed in the following sections.

2.1 Context of team performance

Just like individuals, teams do not operate in a void. Several factors affecting team performance have been postulated. Adapted from Tannenbaum, Beard and Salas (1992) a model of team performance has been developed by Salas, Cannon-Bowers and Blickensderfer (1995a). In this input-throughput-output model many variables are distinguished that have an effect on team effectiveness. The input-part of the model describes the individual characteristics, the team characteristics, the task characteristics, and the work structure. The throughput-part of the model covers the team processes and the team interventions. The output-part of the model specifies the team changes (*e.g.* new roles, new norms), the team performance, and the individual changes (*e.g.* attitude, motivation, mental models). The team performance serves also as feedback and, consequently, affects the input of the model. Both input, throughput, as well as output are being influenced by organizational and situational characteristics like reward systems, management control, and intergroup relations.

To be effective, a training system must take the above-mentioned factors into account. Training must prepare the team to perform the operational tasks in the actual task environment. In developing the training, the characteristics of the individual trainees (*e.g.* expectations, abilities) and composition and organization of the team (*e.g.* novice or mature, different roles) are important elements. Of course, the training system itself must be well-balanced regarding, among others, the task, instructional objectives, instructional methods, principles of training, and methods of testing. Also, the organizational and situational

characteristics are important factors that influence the effectiveness of the training system. The desired training outcome is a behavior change at two levels: performance in training (*i.e.* the internal validity of the training system) and performance on the job (*i.e.* the external validity of the training system) (Cannon-Bowers, Salas, Tannenbaum & Mathieu, 1995; Gaines-Robinson & Robinson, 1989; Romiszowski, 1981; Salas & Cannon-Bowers, in press).

2.2 Team tasks

In contrast to individual tasks, no proper definition of a team task has been presented. In some studies (*e.g.* Drucker & O'Brien, 1981; Olmstead *et al.,* 1975, referred to by Levine *et al.,* 1988) the system an officer is part of, has been analyzed. For instance, a gunner is part of the system 'tank'. Both individuals and teams are part of the system. From the missions of a system, the tasks of the officers can be derived and further analyzed. The problem, however, is that the focus usually is on the individual tasks, and that team tasks have been largely neglected. However, Levine *et al.* (1988), in their model of team functioning, did make an explicit distinction between individual and team task behaviors. The (total or sub-) team task behaviors are indicated as "functions", as contrasted to individual task behavior. But this does not seem to provide a clear indication. In order to perform its missions, a system has to be able to accomplish so called system-functions. Functions are accomplished by the system rather than by mere humans. For instance, the mission of a mobile weapon system (like a tank) is the elimination of a hostile weapon system. In order to accomplish this mission, the system has the following system functions: mobility, target acquisition and engagement, coordination, and system maintenance. In order to accomplish these functions, individuals and teams of officers have to perform tasks making use of the possibilities the system offers (*e.g.* locking on an enemy target). In this view, a function is accomplished by the system, while tasks are being performed by an individual officer or a team (Van Rooij & Van Berlo, in press).

So, what is a team task? A team consists of at least two individuals. This implies that a team task must be performed by at least two individuals: that is, it can not be performed by just one individual. Tasks of members within a team are interdependent. This indicates that the subtasks of which the team task is comprised of, and are performed by individual officers within a team, are interdependent as well. Because a team task is performed by several individuals, the activities and responsibilities of each individual officer must be clearly defined. Moreover, a team task (especially within the military) has to be accomplished under high workload and time pressure conditions. This brings us to a definition of a team task: a team task is a task performed by at least two individuals whose subtasks/activities are interdependent, and has to be accomplished under conditions of high workload and time pressure; the activities and responsibilities of each team member are clearly specified. The main difference between a team task and an individual task is that a team task can not be performed by just one individual officer. Moreover, the interdependency between officers' tasks within a team task is not a feature of a task performed by an individual officer.

Let's take the Stinger team, consisting of five team members (one commander, two marksmen and two reserves) as an example. The mission of the Stinger team is to defend an object that can be attacked by enemy fighters or helicopters. One of the marksman's individual tasks is to operate the missile launcher. Observing the air however is a team task: it is impossible for one individual to observe the whole sky. Therefore, every team member observes a particular part of the sky. Another team task is engaging an enemy target: the commander assigns the target to one of the marksmen, the marksman locks the target, the commander identifies the target (friend or foe), and the commander decides whether to engage or to withdraw.

2.3 Team skills

For a team to perform adequately it is required that the individual team members are sufficiently proficient to act as part of a team. Therefore, each team member must master both his individual task(s) and the team task(s). An individual team member's task is a task performed by the individual officer alone. For instance, the sonar operator is the only one to listen to and discriminate between the sound signals the sonar provides. But because the sonar operator is a member of a team, he has to communicate the interpretation of the signals to the other team members, on the basis of which another team member determines the most appropriate action. Besides just performing his individual task, he has to act as a member of a team. It are the knowledge, skills and attitudes required for a team to perform adequately that is further elaborated in this section. Next, the literature regarding dimensions of team performance will be briefly described, followed by an evaluation.

Description of team performance

Morgan *et al.* (1986) and Glickman *et al.* (1987) suggest that team performance includes two distinct dimensions: taskwork and teamwork. Taskwork relates to behaviors required in the execution of individual subtasks embedded within the team task. Understanding task requirements and operating procedures are examples of these so called operational skills (Salas, Morgan & Glickman, 1987). Teamwork relates to behaviors required for cooperative functioning within a team. A proper attitude towards the other team members, adaptation to varying environmental demands and exchanging information are examples of these so called generic skills (Salas, Morgan & Glickman, 1987). Taskwork as well as teamwork are essential for adequate team performance.

Cannon-Bowers, Tannenbaum, Salas and Volpe (1995) present a rather similar, but more explicit division of team competencies. A team competency is the combined application of knowledge, skills and attitudes to complete the team's mission and the constituent team tasks. Dependent on the characteristics of the task and the team, several types of competencies can be distinguished. The authors state that there are team generic and team-specific competencies (p.337−338). Team generic competencies are held by an individual team member and can influence team performance regardless of the particular teammates involved (*e.g.* communications skills, interpersonal skills). Team-specific competencies on the other hand only have impact with respect to specific team members (*e.g.* certain compensation

strategies). Both team generic and team-specific competencies can be either task-specific or task generic. Task-specific competencies are applicable only to one particular task (*e.g.* role assignment), while task generic competencies are transferable to other team tasks (*e.g.* planning). Combining these factors produces four categories of team competencies: context-driven (both team-specific and task-specific), team-contingent (both team-specific and task-generic), task-contingent (both team-generic and task-specific) and transportable competencies (both team-generic and task-generic) (Cannon-Bowers, Tannenbaum *et al.*, 1995). The nature of the required team competencies is *context-driven* in case of high task interdependence. The nature of the required team competencies is *team-contingent* in case of low task/environment stability, low team member turnover, low membership in multiple teams, and/or high variety of tasks performed by the team. The nature of the required team competencies is *task-contingent* in case of high task/environmental stability, high team member turnover, and/or low variety of tasks performed by the team. The nature of the required team competencies is *transportable* in case of low task interdependence and/or high membership in multiple teams (Cannon-Bowers, Tannenbaum, Salas & Volpe, 1995). For each category, the authors propose the distinctive knowledge, skills and attitude components. According to the authors the characteristics of the training system should vary as a function of the kinds of competencies necessary for the team (p.336).

Evaluation

The teamwork-taskwork distinction (Morgan *et al.*, 1986; Glickman *et al.*, 1987) seems to be an artificial one. Both are required for an adequate performance of the team task. Besides, the interpretation of teamwork appears to depend on the specific task: 'adaptation to varying environmental demands' and 'exchanging information' (Salas *et al.*, 1987) are meaningless without the task and the environment in which it is performed.

The same holds true for the team competencies as defined by Cannon-Bowers, Tannenbaum *et al.* (1995). With regard to the operational task, both team and task competencies (either generic or specific) are necessary for performing the team task adequately. The generic competencies can not be trained in isolation, but need to be embedded within the context of a task; preferably the operational task of which it is derived. Training all the competencies has to take place in a learning environment resembling the operational task environment anyhow to have the highest chance to success. So, the function of the distinct competencies is not clear when actually developing team training programs.

Moreover, the categorization of team competencies according to Cannon-Bowers, Tannenbaum *et al.* (1995) raises some difficulties. Within the military, most teams and team tasks are characterized by high task interdependence, low membership in multiple teams, possible team member turnover and low variety of tasks. This is a combination of context-driven, team-contingent and task-contingent competencies, and is not covered very well by the categorization.

Besides, the categorization is too absolute. For instance, the difference between high and low task interdependence is not absolute; it is a scale. Further, in combat, stress factors can influence the rate of membership turnover: in that case task/environment stability is low (team contingent), and team membership turnover is high (task contingent): this is not captured by the categorization.

In performing as an effective team (*i.e.* accomplishing the team's mission and the team tasks) the team must possess certain knowledge, skills and attitudes (ksa's), depending on the nature of both the task and the operational environment. However, it is not clear whether these ksa's are team ksa's, the junction of individual ksa's, or perhaps a combination of both team and individual ksa's. An overview of ksa's required for demonstrating team performance as proposed by Cannon-Bowers, Tannenbaum *et al.* (1995, p.358−359) does not provide clarity either. Rather than a team possessing mere team-knowledge, team-skills, or team-attitudes, it also seems that it are the individual team members who possess specific ksa's, applying these in a coordinated way to generate the team performance. As a consequence, a necessary condition is communication and coordination between the team members, so that a reciprocal accommodation of individual team members' ksa's can be effected and the team competencies demonstrated.
Behaviors with an obvious team component are communication, coordination and adaptation. These *skills* must be applied by at least two team members. Consequently, team skill seems a legitimate differentiation in the ksa's required for adequate team performance. *Attitudes* with a clear team component are, for instance, the way team members feel about each other, the degree of cohesion and morale and team potency ("we can do it!"). Therefore, it seems correct to discern team attitude, referring to motivational aspects regarding at least two team members. *Knowledge* is more ambiguous. Possessing knowledge seems to be primarily tied to an individual team member. But it can also be argued that the conjunction of knowledge possessed by two or more team members can be referred to as team-knowledge, for instance: knowledge about the team's mission, the roles, emergency procedures, operating equipment. Based on this knowledge an officer can explain and predict the functioning of the system he is part of, and, consequently, adapt his performance to the system's performance (Rouse *et al.,* 1992). Besides, the actual sharing of knowledge with other team members implies the communication of this knowledge, which is a skill.
As previously mentioned, the team must possess specific knowledge, skills and attitudes to demonstrate a team performance in order to accomplish the team's mission and team tasks. It is argued here that these ksa's do have team components.

3 DEVELOPING TRAINING SYSTEMS

The objective of any training system is to change the competencies of the trainees so they can perform their tasks in the operational environment more effectively and efficiently. The actual task, the context in which it has to be accomplished, and the required skills make up the conditions for the instructional systems development process. A description of the task that is to be learned, and the way in which this will be implemented in a training program, is the output of several consecutive steps. These steps can be subsumed under the headings of analysis, design, implementation and evaluation, and will be briefly described in this section.

In the *analysis* phase the task(s) and the operational environment are described in detail. A mission and task analysis identify the tasks required for accomplishing the mission, the interrelations of the tasks, the major components/constituents of each task and their interrela-

tions, the conditions in which the tasks have to be executed, and the criteria/norms that apply to them. In short, the description of the mission and target task specifies the criterion that has to be met at the end of training. The description of the target task in itself does not indicate whether there is a training need. This requires an analysis of the officers executing/performing the target task. Such a target-group analysis provides the current knowledge, skills and attitudes of the trainees. A training need exists if there are insufficient ksa's available within the target group for executing the (team) task(s) and accomplishing the mission. This results in an overview of the instructional objectives. In the phase of *design* the instructional objectives are being analyzed, allocated to a learning environment and sequenced. The instructional strategies are defined, and scenarios for instruction and practice are developed. Also the functional and technical specifications of the training devices are drawn up. This is followed by the *implementation* phase in which specifications are implemented into a prototype of the training program (including the training devices), that is being field-tested. Afterwards a pilot study is being conducted. Also in this phase the documentation (*e.g.* a user-guide for specific training devices and instructor guidelines) is written. In the *evaluation* phase decisions are made regarding the way of performance assessment, the possibilities of automatic on-line registration and interpretation of measurement data, and the overall assessment of the training system's efficacy. Moreover, the ambition is to develop a training system in the most cost-effective way. These phases comprise an iterative process: the design of a component of the instruction can be implemented in a prototype and subsequently be evaluated. The results of the evaluation could result in an adjustment of the design, or even in a reconsideration of the analysis.

The developmental phases constitute a well known methodology for developing training systems (*e.g.* Van Berlo, 1995). How to exactly follow the distinct steps that comprise these developmental phases, is depicted in guidelines. Developing team training systems can include the same phases of development: tasks and the requisite knowledge, skills and attitudes have to be analyzed; instruction, practice and training devices have to be designed; the training system has to be field tested; the training system must provide for assessment of the trainees, and it must be evaluated itself. However, the guidelines to follow the steps could be somewhat different. For instance, analyzing a team task probably poses different demands than analyzing an individual task. Also, designing scenarios for instruction and practice of the team is somewhat more complicated than it is for individual trainees. Team training devices have other requirements (*e.g.* communication processes) than training devices for individual trainees. Further, assessing the team's performance is more complex. To what extent guidelines are already available for developing team training systems will be described in the next chapter.

4 DEVELOPING TEAM TRAINING SYSTEMS

In this chapter, some guidelines in the area of team training will be described and discussed. These guidelines are directed at phases of instructional development as a whole rather than just one aspect of it. For the time being, specific elements, like providing feedback will be left out of consideration.

As described in the previous chapter, developing instructional systems consists of several distinct phases: analysis, design, implementation and evaluation. With regard to team training, the analysis phase is partly described by the MAP system (Levine *et al.*, 1988, 1991) and is discussed in § 4.1, and the TEAM model (Morgan *et al.*, 1986; Salas *et al.*, 1987; see § 4.2).
The phases of both analysis and design are described by the theory of Kribs and Thurmond (referred to by Armstrong and Reigeluth, 1991; discussed in § 4.3), the TIP theory (Armstrong & Reigeluth, 1991; see § 4.4) as well as the propositions for team training by Cannon-Bowers, Tannenbaum *et al.* (1995; see § 4.5).
Guidelines for developing training scenarios during the design phase will be discussed in § 4.6 (Prince *et al.*, 1993; Beard *et al.*, 1995; Schank *et al.*, 1993/1994).
The phases of design and implementation are partially described by the TIPM model (Guerette *et al.*, 1987; Miller *et al.*, 1987) and discussed in § 4.7), and the Teamwork and Instructional Characteristics Checklists (Swezey *et al.*, 1992; see § 4.8). These checklists also partly describe the evaluation phase.

4.1 Multiphase Analysis of Performance (MAP) system

Description

To optimize the chances for success, an instructional program should be oriented towards the task an officer performs in the operational environment. For team training systems the same holds true. Nevertheless, procedures for performing a team task analysis have not been developed in the same thorough way as for individual tasks. For analyzing team tasks virtually no methodology has been described in the literature. An exception is the Multiphase Analysis of Performance (MAP) system developed by Levine and coworkers (1988, 1991). The Multiphase Analysis of Performance (MAP) system considers both variables unique to team performance as well as team training. The MAP system consists of a taxonomy for team training. First, the instruction can be aimed at the individual team member or at the team as a whole. Next, both individual and team can be either experienced or inexperienced. Finally, training can be directed towards interpersonal skills or production skills (comparable with generic skills and operational skills, respectively). Combining these levels results in an eight-cell job analysis taxonomy for team training (Levine *et al.*, 1988; Levine & Baker, 1991) (see Appendix A). For each cell, the authors have indicated the descriptors which characterize the team task, the sources of data that can be regarded, the most adequate methods of data collection, and the methods of data analysis. These are summarized next.
Levine and Baker (1991, p.16−19), and Levine *et al.* (1988, p.55−58) distinguish the following *job analysis descriptors*: (1) supra-system philosophy, climate, structure; (2) licenses and other governmental requirements applicable to team members; (3) responsibilities and mission of teams and team members; (4) professional standards and internal norms required of team members; (5) environmental contexts; (6) products and services provided by the team and team members; (7) machine, tools, equipment and job aids; (8) team performance indicators and standards; (9) physical and psychological demands on team members; (10) elemental motions performed by team members; (11) team and team

members internal processing activities; (12) team and team member tasks/activities; (13) team member attributes; (14) critical incidents. At minimum the tasks/activities and team member attributes should be described.
The authors discern the following *sources of data*: (1) team analysts; (2) officers/supervisors overseeing the team or team members; (3) higher ranking officers/executives; (4) team members; (5) technical experts; (6) team trainers; (7) supra-system liaisons; (8) other supra-system representatives; (9) written documents. The most important information will be obtained from the team members and their supervisors. Technical experts on training are helpful when the team is not yet functioning.
The *methods of data collection* are: (1) observation; (2) individual or group interviews; (3) technical conferences; (4) questionnaires; (5) diaries; (6) equipment based methods; (7) reviewing records/literature/equipment specifications; (8) doing the work. Interviews are indicated as being the most important method of data collection.
Finally, the authors describe the following *methods for analyzing/synthesizing data*: (1) duties (*e.g.* task clusters); (2) tasks/activities; (3) elemental motions; (4) team and team member performance dimensions; (5) team member attribute requirements; (6) scales applied to units of work (*e.g.* task importance); (7) scales applied to team member attributes (*e.g.* is an ability essential for new team members?); (8) qualitative versus quantitative analysis. At a minimum, scales applied to tasks and a listing of tasks/activities should be used.

Evaluation

Task analysis is a significant step in the process of developing a training system. The MAP system provides a methodology for conducting a team task analysis. It differentiates for type of skill (interpersonal or production), level of proficiency of the target group (experienced or inexperienced), and whether the training should be aimed at the individual team member or the team as a whole. Besides, guidelines are presented regarding the kind of information to be collected, the sources of information, the methods for data collection, and the methods for data analysis. The MAP system has been tested in the field: the results were that the tasks could be described in an adequate way, that the MAP system could be applied efficiently, and that it is a user friendly system. The subject matter experts (sme's) involved in the field test perceived the MAP system as a valuable method in the process of developing team training (Levine & Baker, 1991).

There are, however, some critical remarks. The first remark concerns the usability of the MAP system in developing team training systems. The results of the team task analysis gathered during the field test have not been used for actually designing a team training program, although this would be the ultimate check of the MAP system's usability. A corresponding problem, as indicated by the sme's, is the difficulty of generating the knowledge, skills and attitudes required for performing the (team) task; however, the ksa's are the crucial input in defining the instructional objectives for designing team training.
Next, the relationship between type of skill (interpersonal or production) and the job analysis descriptors is not clear. The MAP system first prescribes to determine whether the training should aim at the individual or the team, the experience level of the target group, and whether the training should be directed towards interpersonal or production skills. When this is determined, the analyst knows which cell of the MAP system he must focus on and,

consequently, knows which descriptors should be identified. However, the descriptors provide information enabling the analyst to select the most adequate cell of the taxonomy. Therefore, selecting the right cell of the MAP taxonomy does not seem to be that obvious.
Further, the contents of the cells remain unclear. As discussed in the previous section, Levine and Baker (1991) present several descriptors, sources of information, methods of data collection, and methods of analysis. Yet in the MAP taxonomy not every distinct item recurs in the taxonomy, viz. descriptors (2), (4), (10) and (11); sources of information (1), (7) and (8); methods of data collection (5) and (6); methods of analysis (3) and (4). Besides, two methods of analysis are presented (9 and 10) that are not being specified.
Finally, selecting the sources of information is more likely to be intertwined with the job analysis descriptors rather than that it results from selecting the descriptors, as the sources of information can constrain the description of the job.

4.2 Team Evolution and Maturation (TEAM)

Description

The TEAM model (Team Evolution and Maturation) is based on the assumption that a team passes through several phases in becoming a proficient team (Morgan *et al.*, 1986; Salas *et al.*, 1987). As the training progresses the team learns more about the operational team task itself, the demands posed by the task environment, the abilities and characteristics of the other team members, and about working, coordinating and communicating collectively. This process, the maturation from an unskilled and immature team towards a skillful and mature team, has been classified into nine phases (see Fig. 1). After it is clear who will be a member of the team (pre-forming), the team meets for the first time (forming). Next the team develops, by means of internal conflicts (storming) and the settlement and acceptance of team norms and the distinct roles within the team (norming), towards a team that is attempting to perform a task collectively (performing-I). At first some mistakes will be made, but the assessment of the performance (reforming) leads to an accommodation of accomplishing the task and/or the role assignment within the team (performing-II). This results in a novel and collective accomplishment of the team task in a more adequate way, explicitly taking situational elements into account (conforming). From the conforming-phase the team returns to the performing-I phase and passes through this cycle again until the team task is being accomplished in the most adequate manner. As a last step, the team can be resolved at this point (deforming). However, it is stated that not every team should always proceed all the distinct phases.

In the TEAM model a specific distinction is made between taskwork and teamwork. To attain an optimum effect of the team training it is assumed that both taskwork and teamwork should first be trained separately. Gradually these skills should be trained more integrated, so eventually both skills can be applied in performing the team task.

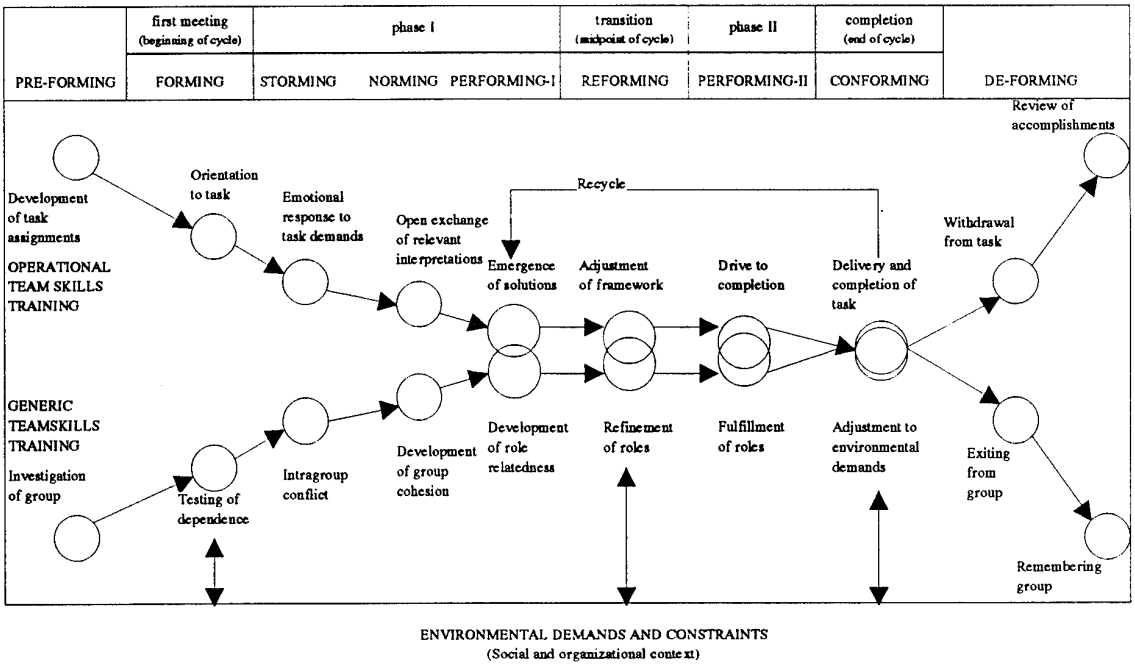

Fig. 1 A generalized model of Team Evolution and Maturation (Salas, Morgan & Glickman, 1987, p.84).

Evaluation

The underlying assumption of the TEAM model is that a team matures by passing through the developmental phases as described. These phases are assumed to be rather naturalistic, that is, occurring quite spontaneously. This process of team maturation is being transferred directly into a team training model. It can be questioned however whether this naturalistic maturation process is the most effective process in training a team to become mature. For instance, the phases of storming and norming could be more efficiently and effectively implemented by not leaving this entirely to the team itself, but directly instructing the team regarding the norms and roles. Besides, in this way the instructor can control the learning process more effectively. Also the deforming of a team at the end of a training seems rather misplaced, because at that point the team is about to perform the team task in the operational environment.

The TEAM model has been field tested by developing a team training for the Naval Gunfire Support (NGFS) (Montero *et al.*, 1987). Based on the characteristics of the target group and the distinct team development phases, instructional strategies have been formulated that are to be applied by the NGFS-instructor. The results of this try-out seem to support the TEAM model (Salas *et al.*, 1987). However, the way the instructional strategies are formulated is not a part of the TEAM model. The model only indicates which processes are manifest while training a team. No guidelines are presented whatsoever regarding the possible instructional strategies, training methods, and activities the instructors should apply during the team development phases.

4.3 Kribs/Thurmond

Description

One of the first systematic approach to developing team training is presented by Kribs and Thurmond (1978, referred to by Armstrong & Reigeluth, 1991). This approach is aimed at developing learning/instructional strategies using computer-aided instruction modes for team training. They argue that there is a clear relationship between conditions on the one hand, and instructional methods on the other. The conditions are related with environmental factors and the structure of the team. Environmental factors can be more or less constant, resulting in a more or less constant accomplishment of the tasks. The team structure is determined by the nature of the team task: in case of a serial structure the team members perform their tasks successively, and in case of a parallel structure they perform their tasks at the same time. Based on these conditions Kribs and Thurmond (1978, referred to by Armstrong & Reigeluth, 1991) prescribe some methods of instruction, which indicate several team development phases. The overall strategy is that the distinct team members should first be trained individually before the team as a whole gets trained. The learning/instructional strategies for individual team member training are comprehension strategies, memory strategies and problem solving; the strategies for beginning team training are drill and practice, tutorial and testing; the strategies for integrated team training are socratic tutorial, simulation and testing; and the strategies for emergent team training are simulation, game and testing.

Evaluation

Kribs and Thurmond (1978, referred to by Armstrong & Reigeluth, 1991) have described some guidelines for developing team training based on the presumed relationship between conditions and required learning/instructional strategies. These guidelines, however, are very broad and do not entirely differentiate between the various conditions. The conversion from one team development phase to another is not clearly formulated. The usability of these guidelines is therefore questionable. Besides, the learning/instructional strategies are primarily aimed at computer-aided instruction and it is not clear to what extent these are transferable to other learning environments.

4.4 Team Instructional Prescriptions (TIP) theory

Description

The Team Instructional Prescriptions (TIP) theory (Armstrong & Reigeluth, 1991) is only directed towards training of whole teams, and excludes the training of individual team members. The TIP theory contains four elements: the desired output, the conditions, the instructional methods, and a set of guidelines in which output, conditions and methods are being integrated. These four elements will be described next.

The **result** of team training is twofold: it is directed at both teamwork and the team task (cf. Salas *et al.*, 1987). Team training intends to prepare the team on both aspects.

The **conditions** influencing team training are comprised of three types of variables: the team development phases, the task process dimensions and relationships between tasks. Armstrong and Reigeluth (1991) distinguish between three *team development phases*: forming, performing I and performing II. These phases are very similar to the team development phases as indicated by Morgan *et al.* (1986, see § 4.2). The next type of condition variables are the *task dimensions*. First, a task can be comprised of interdependent or independent part tasks. In case of interdependent part tasks the tasks must be performed sequentially, while independent part tasks can be performed parallel to each other. A second task dimension is the distinction between the so-called procedural and transfer tasks. A procedural team task should always be performed in an equal manner. A transfer task on the other hand can be performed somewhat differently each time it is repeated: the distinct steps could be the same, but the sequence and specific execution could differ. The combination of these two task dimensions results in a classification matrix containing four different types of team tasks. The final type of condition variable are the *task relationships*. Armstrong and Reigeluth (1991) distinguish three types of relationships: superordinate team tasks (*e.g.* moving into a position by a tank is composed of, among others, moving to the location, occupying the position, camouflaging the tank), coordinate team tasks (*e.g.* moving to the location, camouflaging the tank), and subordinate team tasks (*e.g.* moving into a position by a tank is part of the overall task of taking a position by the tank platoon).

The **instructional methods** are discussed at three levels of strategy: macro, mid-level and micro strategies. At the macro level the trainees are being informed about the context in which the team task is performed, and the relationships with other tasks. During the instruction the context will first be interpreted, followed by an interpretation of the task(s), and finally the connection between context and task(s). At the mid-level the succession of the distinct steps comprising a task is explained. The instructional sequence depends on the mutual relationships (interdependent or dependent) between the steps (see previous section). During the instruction the task must be illustrated first, followed by the various steps the task encompasses, and finally the relationships between the steps will be illustrated. At the micro level it is demonstrated how one single concept, procedure or principle should be trained. This is the lowest level on which the team members will be prepared for their roles and tasks, and contains four steps: a) label and define roles and tasks, b) present prototypical roles or task performances, c) discriminate between more or less similar roles and tasks, d) practice by the team and team members. Practice is an essential phase: it can be both collectively and individually based, the amount of help and guidance provided by the instructor can vary, and it can be more or less realistic. As the training progresses, practice must more and more approximate reality. Practice can be either process-driven or product-driven. Process-driven practice emphasizes the procedure by which the team task has to be performed. Product-driven practice highlights the output of accomplishing the team task. During team training opportunities for both process- and product-driven practice must be offered.

Result, conditions and instructional methods are integrated into a coherent set of prescriptive guidelines. The TIP theory contains three models, each representing a team development phase (Fig. 2). Each model (a slice of the cube) consists of a combination of task relationships and the task dimensions (process). Each model embraces the instruction and practice regarding the role the individual team member has within the team: the more the team matures, this role-instruction and practice will be more specific. The three models will be briefly discussed below.

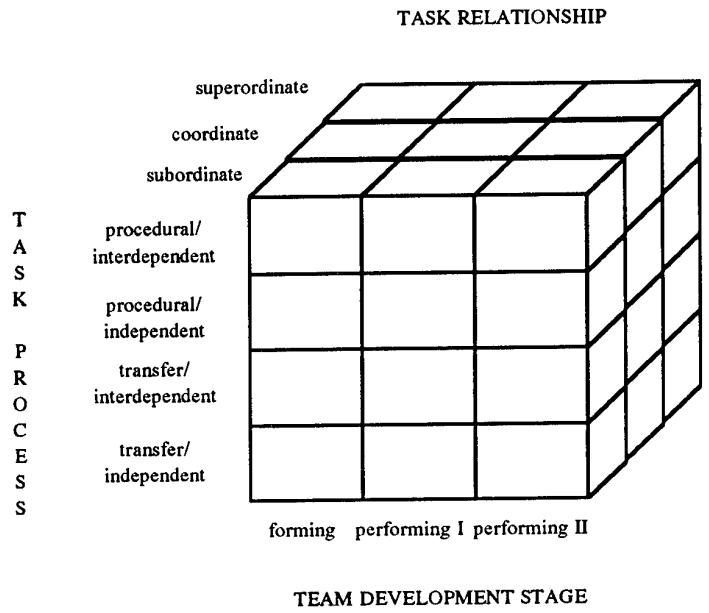

Fig. 2 The TIP theory (Armstrong & Reigeluth, 1991, p.21).

The Team Forming Model is related to inexperienced teams. The emphasis is put on knowing the various roles rather than performing the task. During practice the instructor explicitly guides the team. The level of realism is less than in the operational environment. With procedural tasks the process of task accomplishment is stressed because the distinct steps and the results are relatively stable. However, instruction on transfer tasks is product-centered, because the steps are not standardized: in this case an unstructured roleplay seems an appropriate type of practice.

In the Team Performing I Model aspects of both teamwork and taskwork are highlighted. The team can perform the team task in a moderate way, but some supervision provided by the instructor remains necessary in case the team makes errors. Practice matches reality more than it did in the team forming model, and can be directed at either team of individual team member performance.

Finally, the Team Performing II Model prescribes the way the experienced team should be trained. Emphasis is put on taskwork and less on aspects of teamwork. The team practices in a realistic learning environment without notable guidance of the instructor.

Evaluation

The TIP theory is a good attempt to link the team development phases, as described by Morgan *et al.* (1986), with prescriptive instructional guidelines. The nature of the task (procedural/transfer, interdependent/dependent) and elements of both teamwork and taskwork are being integrated within the TIP theory. Practice is highly important: guidance is provided for more or less realistic exercises, directed at the team or individual, with a more or less prominent role of the instructor.
Nevertheless some critical remarks can be made. The result of the training is assumed to be twofold: performance improvement on teamwork and the team task. As already indicated (see § 2.3), this distinction seems to be an artificial one. Both are required for an adequate performance of the team task. Additionally, the interpretation of teamwork appears to depend on the specific task and the environment in which it is performed. Also, much emphasis is placed upon the different levels of analysis at which a team task can be viewed. The context in which the team task is performed and the conditions of task performance are considered as highly important. However, how to analyze the team task is not explained at all.
Next, the definitions of procedural tasks and transfer tasks are very unusual. Usually a procedural task is defined as a task that can be performed according to a well described set of distinct operations; a transfer task is a task that is different from, but also has some similarities with, a previously learned task. More common definitions are closed and open tasks, resp. (Patrick, 1992). Moreover, the micro level of instruction seems to be primarily directed at the individual trainee, although the TIP theory claims to address only whole teams. How the instructional methods at the micro level are related with collective training remains unclear. Also with respect to the instructional methods, the phase of practice is somewhat vague. Armstrong and Reigeluth (1991) state that practice is either process-driven or product driven. However, this does not seem to be a correct distinction. It is more likely the feedback that is process- or product-driven; plausibly the practice will be the same.
Further, in the integrated theory the presented instructional guidelines are very general: the possible methods of instruction are not specified, the instructor's role is not explained, and the measurement of team performance is not illustrated. The transition from one team development stage towards another stage is not explained. Finally, as the authors (Armstrong & Reigeluth, 1991) have already indicated themselves, the TIP theory yet lacks an empirical validation.

4.5 Propositions for team training

Description

Cannon-Bowers, Tannenbaum, Salas and Volpe (1995) presented a framework providing four types of team competencies based on situational and task characteristics (see § 2.3). Based upon this framework the authors offer sixteen propositions regarding the nature of team training required for developing specific competencies in teams and regarding the most successful strategies. The propositions fall into two related categories: those that involve the manner in which the task and situational (*i.e.* environmental) characteristics influence the

nature of the team's competency requirements, and those that link the categorization of team competencies to training requirements and strategies (Cannon-Bowers, Tannenbaum *et al.*, 1995, p.366−371).

Propositions linking situational or task characteristics to team competencies:

1 High interdependency in a team task requires team members to possess context-driven competencies.
2 Teams that operate in an environment that is fairly stable require task-specific but not necessarily team-specific competencies.
3 In teams where turnover is rapid, task-specific competencies are required and team-specific competencies are less crucial.
4 Team members who hold membership in multiple teams require, at the minimum, transportable team competencies.
5 When team members interact together across a variety of task, team-specific competencies are required; task-specific competencies may be less feasible (or necessary) to develop in such cases.

Propositions linking team competencies to training requirements or strategies:

6 Teams that require team-specific competencies, whether they fall into the team-contingent or context-driven categories, will benefit from training as intact teams.
7 Teams that require task-specific competencies, whether they fall into the task-contingent or context driven categories, should be allowed to practice in the actual task environment (or in one as close as possible).
8 Training for teams that require team-specific competencies, in either the context-driven or team-contingent categories, should incorporate feedback that leads to shared or common expectations for task performance.
9 When transportable competencies are required, some training can be focused at the individual level.
10 Task simulation may be an effective training strategy for teams that require task-specific competencies requiring actual practice. Further, task simulation can be an effective means of imparting team-contingent competencies if the operational team members are allowed to practice together (and only under these conditions).
11 Cross-training may be effective for teams that require exposure to the task (that is, task-specific competencies, whether they fall into the context-driven or task-contingent categories).
12 Positional knowledge training may be useful for teams with task-specific competency requirements, either context-driven or task-contingent.
13 Training to impart context-driven competencies should include guided practice that exposes the actual team members to the variety of situations they may confront on the job. When the actual team cannot be trained intact, guided practice may be useful as a means of training task-specific (but not team-specific) competencies.
14 Lecture-based training may be appropriate for transportable competencies but should be considered only as a first step for other types of competencies, since these require experience with the actual task or team.
15 Role playing may be used effectively to train team-contingent competencies when it involves the actual (operational) team.

16 Passive demonstrations of the task may be an effective means of training task-contingent competencies.

In summary, the proposed training strategies for context-driven competencies are task simulation, guided task practice, role playing (all for intact teams) and cross training; the proposed training strategies for team-contingent competencies are task simulation, guided task practice and role playing (all for intact teams); the proposed training strategies for task-contingent competencies are task simulation, cross training, guided task practice, role playing and passive demonstration; the proposed training strategies for transportable competencies are lecture and passive demonstration.

These propositions can be supplemented with more general principles of team training as has been done by Salas and Cannon-Bowers (in press), and are adapted from Salas, Cannon-Bowers and Blickensderfer (1995a, p.101 – 102). These principles are not focused at specific team competencies but at a team training system in general:

a Individual proficiency must precede team training
b Team training must evaluate, diagnose and remediate team performance
c Team training systems must allow for: information presentation, demonstration of teamwork competencies; practice and feedback
d Team training must emphasize the nature of task interdependency
e Team training must emphasize teamwork competencies
f Team training must create systematic opportunities to practice the required team competencies.

Evaluation

Cannon-Bowers, Tannenbaum *et al.* (1995) made a major contribution to the theory of developing team training. They advocate a task-based approach when proposing training strategies for training teams in the most effective manner. The propositions are related to the distinguished team competencies, except the team- and task-generic competencies. The question is whether it is appropriate not to do so while at the same time formulating propositions regarding the team- and task-specific competencies, as well as the combination of (generic and specific) team- and task-competencies.
Corresponding to the previous discussion of the team competencies (see § 2.3) the differentiation between teamwork and taskwork seems to be too absolute. For instance, proposition 11 states that cross-training may be effective for teams that require exposure to the task: but, what else should the training be directed at besides the actual task? Another example is the third proposition which states that, in case of high degree of turnover of team members, task-specific competencies are required and team-specific competencies are less crucial. But this could be easily stated in reverse: due to the fact that the team members have to cooperate with multiple and exchanging team members, in this case team-specific competencies should be trained. These examples demonstrate that both teamwork and taskwork are required for effective team performance, and both should be instructed intertwined; however, each type could be emphasized more or less during the instruction. Possibly this will be different for immature teams (initial training) and expert teams (mission rehearsal, refreshment training), but no clear statements are made regarding this point.

Another point of critique concerns the architecture of the training program. The propositions for training design are primarily focused on the link between a particular competency on the one hand, and a training strategy on the other. No guidelines have been proposed regarding the architecture of the entire training system. Only with the transferable competencies it is stated that these should be considered as a first step before other types of competencies can be trained.
Proposing training strategies does not imply that it is clear for the instructional developer how to design and implement these strategies into a training system. For instance, is there any distinction in cross training with respect to context-driven competencies and task-contingent competencies? And why isn't cross training a strategy for intact teams? Nevertheless, a great deal of the training system's success depends on an adequate implementation of the strategies, and on the skills of the instructor. Therefore, the propositions should be extended in this direction.
The propositions should also be validated empirically. The authors (Cannon-Bowers, Tannenbaum *et al.*, 1995) have indicated that the propositions are easily stated as testable hypotheses.

4.6 Guidelines for scenario design

A critical aspect of developing training systems is the design of scenarios. Scenarios should support the trainee's development of the to-be-learned skills in an effective way (Bowers *et al.*, 1993). However, the development of training scenarios usually is an ad-hoc, and not very systematic process. There are hardly sufficiently detailed and usable guidelines available. Training scenarios most often are designed by experienced subject-matter experts who overlook the relevance of some training tasks for the operational practice, or who emphasize only one aspect of the mission performance. Such training scenarios could result in worse team performance and even in a negative transfer of training (Bowers *et al.*, 1993). In this section some guidelines regarding the design and development of training scenarios will be discussed.

Description

A training device that is frequently applied in team training is a simulator. Prince *et al.* (1993) presented guidelines for simulator scenario development with respect to crew resource management behavior training. Based on existing guidelines (Federal Aviation Administration, 1990; Lauber & Foushee, 1981) and practical training experience, Prince *et al.* (1993) formulated their guidelines. These will be briefly illustrated next.
A precondition for developing training scenarios is that the tasks and skills are analyzed well, and that the instructional designer has domain specific knowledge. The guidelines are separated into five categories: scenario overview; objectives; realism; role of the facilitator; technical tips. The category of "Scenario overview" considers the segments that could comprise a scenario, and what the briefing phase should include. The other phases (pre-flight planning, flying, debriefing) are highlighted in the following categories. The category of "Objectives" includes among others that the scenario should be developed based on the instructional objectives, and that all relevant objectives should be incorporated. Also, a

scenario should be part of a total training program and the scenarios should mutually vary in levels of difficulty. The category of "Realism" includes among others that scenarios should be real-world and real-time, including dull and irrelevant aspects. Many items can enhance the reality, especially when these items have a constraining influence on the performance: headphones, gloves, helmet and uniforms. Just like in the real world, all crew members should be involved in the scenario. The restrictions of the simulator however should be taken into account when striving for reality. The category of "The role of the facilitator" includes that the role of the facilitator should be explicitly scripted because (s)he can have varying roles: team member, commander, assessor of the trainees' performance. The facilitator should be well prepared and trained for his role(s), and he should focus in the debrief on the objectives of the scenario. The category of "Technical tips" includes, among others, the performance of a try-out, and the modular architecture of a scenario to enhance the interchange of distinct components. Further, the trainees should be given ample opportunities to display the to-be-learned behaviors.

Another endeavor to formulate guidelines for the design of scenarios has been undertaken by Schank and his co-workers (1993/1994). They focus on so-called Goal-Based Scenarios that can be performed by the trainees in a computer-based learn-by-doing environment. A Goal-Based Scenario (GBS) is a definition to emphasize that a training scenario should be task-oriented, with clearly specified objectives. Schank *et al.* (1993/1994, p.322−323) identify seven general criteria that a GBS design should meet: thematic coherence, realism/richness, control/empowerment, challenge consistency, responsiveness, pedagogical goal support and pedagogical goal resources.
A GBS consists of several components that should be identified successively, and will be briefly described in this section. First, the **mission** specifies the goal the trainee is trying to accomplish. It is stated in general terms. The mission is being specified in the **mission focus**. The mission focus describes the predominant activity/task that should be performed by the trainee. One mission could have more than one mission focus. A mission focus can be classified in four categories (Schank *et al.*, 1993/1994, Table 2, p.328): explanation (student's focus is on accounting for phenomena, diagnosing systems, predicting outcomes), control (student runs an organization, operates a system), discovery (student operates in a microworld, infers laws governing that microworld), and design (student creates some artifact, specifies how a system should be organized). Next, the **cover story** defines the role the trainee plays, the set up, and the scenes in which the action takes place. Finally, the **scenario operations** describe the actual activities the trainee will be performing while engaging in a GBS. For each the four components guidelines are presented that are more or less specifications of the already mentioned seven general criteria.

Evaluation

Prince *et al.* (1993) presented guidelines for simulator scenario development based on literature and training experience. It is one of the scarce endeavors undertaken to formulate guidelines regarding this aspect of instructional development. The focus on simulator-based training does not seem to be a restriction for other kinds of team training: Beard *et al.* (1995) formulated rather identical guidelines focusing on role-play. To what extent the

guidelines are applicable to other domains than crew resource management training remains to be examined.
One point of criticism is that it is not clear when artificial or realistic feedback should be provided, nor the moment (direct or delayed) it should be presented. Yet these are important features of a training scenario. Further, the link between objectives and scenario is not obvious. Prince *et al.* (1993) state that based on the objectives the scenarios should be developed, but they also argue that objectives can be modified to fit a scenario (p.73). This implies that the results of the analysis phase could be adjusted to fit a particular scenario. That is, however, not a proper way of instructional design: if it can be concluded that an objective does not appropriately reflect the target behavior, (a part of) the analysis phase should be reconducted in order to formulate a more precise objective. If the objective still is not appropriate, either the validity of the objective or its implementation into a scenario should be questioned. Another point of criticism is that not the entire process of designing a training scenario has been covered: how to develop a blue-print, how to implement it into a prototype, and how to conduct a try-out, are phases that have been described only partially. Finally, the category of "Technical tips" contains guidelines that do not fit into a single category. If the purpose is to present an integrated set of guidelines, this should however be done. Therefore, another categorization of guidelines must be created.

The guidelines presented by Schank *et al.* (1993/1994) are not directed at team training, and are focused on computer-based learn-by-doing environments rather than training simulators. A Goal-Based Scenario has the characteristics of discovery learning, and this is reflected in (some of) the guidelines, for instance: 'operations should present students with the opportunity to exercise strategies to accomplish goals on their own', 'present artifacts through which the student tests his ideas about how to complete the mission'. However, in the military, training and instruction are more directive and strictly organized. Conceivably this poses different requirements for guidelines for designing scenarios.
The value of the framework presented by Schank and his co-workers (1993/1994) is the stratified architecture of a scenario. The mission can be specified into different tasks, which in turn can be detailed into operations. A scenario could be developed on each of these distinct levels, more or less resembling the mission- and task analysis of the analysis phase of instructional systems development. Another significant aspect is the skill-based approach. Although the application of the above described categorization of the mission focus with respect to actually designing training scenarios remains unclear, it does emphasize the need for precisely defining the target-task and the target-behavior the training should be aimed at. Finally, it is stressed that a training scenario should be challenging and motivating for the trainees.

4.7 Team Instructional Processes Model (TIPM)

Description
Based on the experiences with the previously discussed TEAM model (see § 4.2), the Team Instructional Processes Model (TIPM) has been developed (Guerette *et al.*, 1987; Miller *et al.*, 1987). By interviewing trainers and observing team training programs, the team

development phases (Morgan *et al.*, 1987) are linked with specific training strategies. The TIPM contains ten steps that will be described below (see Fig. 3).

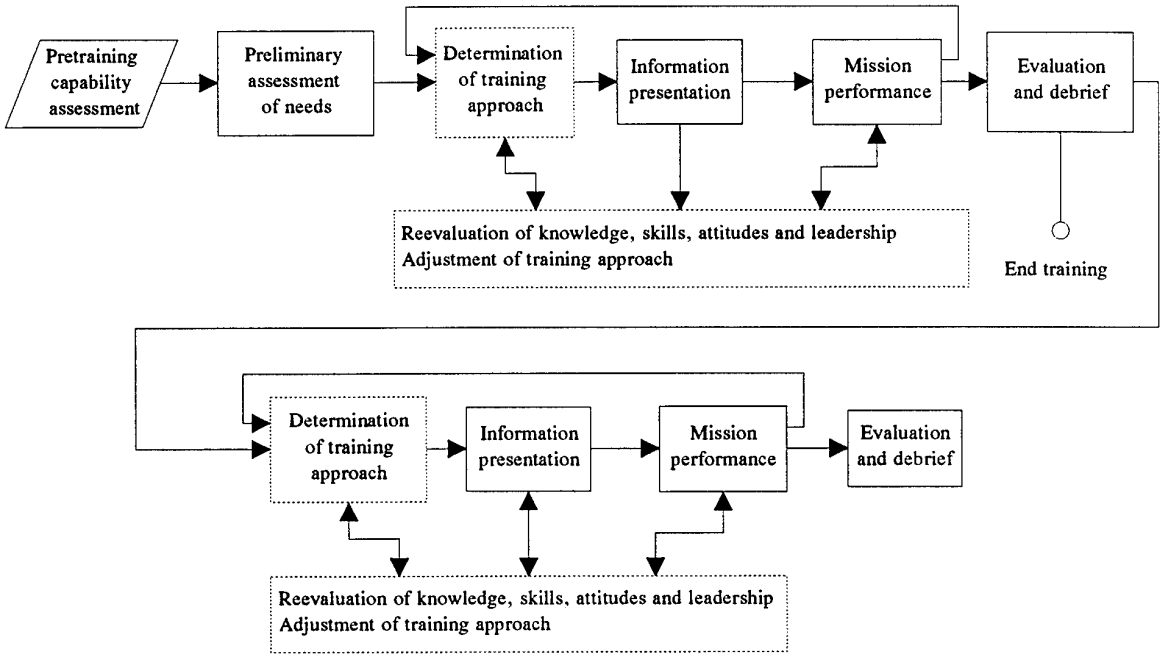

Fig. 3 The Team Instructional Processes Model (Guerette, Miller, Glickman, Morgan & Salas, 1987, p. 9).

The first step of the TIPM consists of the determination of the initial proficiency of the team before the training starts. This target group analysis maps out whether, and to what extent, the team members possess the required skills. During the first meeting of the training the instructor determines the team's initial proficiency in a more profound way, and the degree of the trainees' motivation and attitude (step 2). Based on the results of these steps, in step three the instructor makes a first and broad outline of the instructional program. In the following steps information regarding the tasks and the team's mission is presented (step 4), and the tasks are practiced by the team; in this phase the instructor supervises the team (step 5). The outcomes of these steps can result in an adjustment of the instructor's initial outline of the training strategy. Approximately halfway the training program, it is assessed to what extent the team can accomplish the tasks (step 6). If the team appears not to be capable of accomplishing the tasks, the training will be terminated. If the training is continued, the next steps (7, 8 and 9) equal the previous steps 3, 4 and 5: in this training phase the team gets trained more specifically. Finally, in step 10 it is being evaluated whether the team can perform the team task in an adequate way; this assessment will be followed by a joint debrief.

The determination of the instructional strategies for each step is dependent on the team's initial level of proficiency and attitude. On both dimensions the team can be rated either high or low, resulting in four categories of teams. On the basis of this categorization the instructor selects the method of instruction.

Evaluation

Rather than a coherent set of guidelines for developing team training, the TIPM is a depiction of the endeavors of the NGFS instructional developers and instructors within the framework of the TEAM model. In the ten distinct steps general guidelines for the instructor are presented. For instance, an essential part of the model is the determination of the initial proficiency level of the trainees; how this should be established, however, remains unclear. Regarding the instructional differentiation with respect to the four categories of teams, suggestions do not reach beyond "training the team more or less task oriented". Moreover, this categorization of teams seems to be too absolute: obviously teams will be more diverse.
The midterm evaluation is a remarkable one. In stead of using these assessment data for adapting the training approach to the trainees, the instructor can also determine to end the training. This is a rather rigorous action, and stresses the need for conducting a target group analysis in a thorough way.
During team practice (step 5) it is indicated that the instructor should play a less prominent role, and act more as a facilitator instead. How this should be implemented is not explained. Also, the determination of the contents and frequency of the feedback, as well as the level (individual or team), remains vague. Assessing the level of proficiency takes place at fixed moments with standard exams. Intermediate evaluations, on the basis of which the instructor may or may not accommodate the instructional strategy, remain highly subjective. Besides, the procedure for conducting a debrief has not been prescribed. The authors themselves have already indicated that, in order to formulate a generic methodology for developing team training, research is still necessary (Guerette *et al.*, 1987, p.22−28; also see Chapter 5).

4.8 The Teamwork and Instructional Characteristics Checklists

Description

Swezey, Llaneras and Salas (1992) constructed two checklists supporting the organization and presentation of guidelines regarding the development and evaluation of team training systems: the Teamwork Characteristics checklist and the Instructional Characteristics checklist (see Appendix B). The first step in using each checklist is, for each item, to indicate whether the training program includes the respective (teamwork or instructional) characteristic. This step is followed by scoring the importance of each characteristic on a 5-point rating scale (0=not important; 4=extremely important), regardless of the result of the first step. By combining these two results, shortfalls in the training system can be easily identified.
The Teamwork Characteristic checklist contains 30 items which address a variety of topics, for instance: the team's organizational chain of command, responsibilities of all team members, selection of team operations and tasks, specific attitudes of team members, instructional sequence, definition of performance criteria, summative and formative evaluation, fidelity of the learning environment, and cross training the team members.
The Instructional Characteristics checklist contains 41 items which address, among others, the following topics: the specification of behavioral objectives, the form and amount of feedback, summative and formative evaluation, learning styles and learning rate of the target

group, architecture of the training program (*e.g.* part task training, amount and frequency of testing), the fidelity of the learning environment, the modalities of instruction (*e.g.* sound, graphics), and the correspondence between training objectives and media.

Evaluation

A checklist for the instructional developer and/or the instructor can be a very helpful tool. A checklist enables them to quickly validate the results of passing through the phases of instructional development. In this view, a checklist is a supplement of a methodology and the guidelines of developing a team training system. The checklists presented here merely consist of so called 'reminders'; but it is not clear upon which prescriptive guidelines they are based, although the authors themselves indicate the need for this particular type of guidance (Swezey, Llaneras & Salas, 1992, p.33). However, for team training device design, Swezey and Salas (1987) presented 13 categories of prescriptive guidelines. These categories relate to: audio presentations, control display integration, fidelity, hardware, instructional principles, labelling, maintenance, motivation, safety and hazards, software, user device interface, visual displays and workspace design. For each category guidelines are presented. Nevertheless, although the identified categories are important, the guidelines (Swezey & Salas, 1987) are generic (*e.g.* "high fidelity device features are desirable for new and less experienced trainees", "schematics of every device should be prepared and made available in easily comprehended form to all users") and should be specified in a more profound way, dependent on the characteristics of the task and the trainees.

With respect to the checklists (Swezey, Llaneras & Salas, 1992), it is not quite clear what criteria should be sustained when checking the items. The criteria, and the interpretation of the results, are dependent on the particular training system that is being evaluated. Also the resulting actions the instructional designer should undertake after completing the checklists remain unclear. The lack of both clear criteria and guidance regarding the remediating actions has the danger in it of different instructional designers completing the checklists in different ways and undertaking different follow-up actions.
Further, it can be questioned whether the checklists are exhaustive. For instance, the role of the instructor has not been brought up explicitly, and only one item deals with cross training. Finally, the items of both the Teamwork and Instructional Characteristics checklist have not been systematically categorized; the order of the items seems to be rather random. Besides, the items of both checklists refer to partially similar topics, like characteristics of the operational task and environment, architecture of the training program, formative and summative evaluation, characteristics of the learning environment, and instructional method. One checklist, differentiated according to the distinct phases of instructional systems development, seems a more useful tool. In this way evaluations can be performed during the phases of analysis, design and implementation as well, rather than merely during the evaluation phase.

5 TOWARDS GUIDELINES FOR DEVELOPING TEAM TRAINING

A team training methodology is a coherent set of guidelines, based on principles of learning and training, for developing, designing and delivering instruction to enhance and maintain team performance in the actual, operational task environment. It involves creating a learning environment in which the team members can acquire and practice on the necessary knowledge, skills and attitudes required for adequate team performance. Adequate diagnosing, assessing and remediating the team's performance are essential features of a training system to be effective (cf. Salas & Cannon-Bowers, in press). Given this definition of team training methodology, the four general phases of instructional systems development (chapter 3), and the state-of-the-art as previously described (chapter 4), an inventory can be made up of the missing knowledge in producing an integrated methodology for developing team training systems.

First of all, it is important that the performance deficiencies of a team can be identified. Such a tool for conducting a performance analysis is still lacking (Salas & Cannon-Bowers, in press). Based upon these performance deficiencies, the training needs of the team must be analyzed (Salas, Bowers & Cannon-Bowers, 1995) and a selection of the to-be-trained tasks has to be made (Bowers, Baker & Salas, 1994). Finally, a tool has to be developed by which the task demands and the training needs could be linked with specific training strategies, including proper performance assessment methods and strategies for remediation (Salas, Bowers & Cannon-Bowers, 1995).

There still is not a connection node between the way a team matures, and how the training system should correspond with this process (Salas & Cannon-Bowers, in press). Procedures and tools for optimizing training strategies based on key team variables should be developed (Guerette *et al.*, 1987). Not just the process remains unclear; the way in which the training system should take into account the input variables (*e.g.* characteristics of the trainees and the environment) remains unclear as well. A pre-training diagnostic instrument to assess the team's skills needs to be developed (Guerette *et al.*, 1987). More specifically, gaining insight into the relationship between team attitudes (*e.g.* team cohesiveness) and team performance can benefit the training of teams (Salas, Bowers & Cannon-Bowers, 1995). The same holds true for the impact of the organizational context on the training system. The required output of a team training system (*e.g.* what constitutes a good team performance) needs to be defined in a more complete way (Cannon-Bowers, Salas, Tannenbaum & Mathieu, 1995; Armstrong & Reigeluth, 1991; Salas, Morgan & Glickman, 1987; Miller *et al.*, 1987; Guerette *et al.*, 1987).

A methodology for developing team training systems should be based on principles of learning and training. Ascertaining which principles are prevailing, and how these principles should be applied in team training systems, is a major research question (Salas & Cannon-Bowers, in press).

Complex, technologically advanced learning environments are being developed for team training. As already indicated (see chapter 1) it is often not clear which, and how, instructional principles should be applied to team training systems. The application of new,

advanced technologies like multi media, intelligent tutoring systems, teleconferencing, and distributed interactive simulation should be studied in a more profound way.

Guidelines for designing training scenarios are almost non-existent. Two sets of guidelines have been discussed (see § 4.6) both comprising valuable components. An integrated set of guidelines for designing scenarios, encompassing the entire process of scenario development, is still lacking.

Checking whether the training system has been effective is a very important phase in training. Due to the fact that measuring the results of team training is more complicated than it is for training individual officers, this activity usually is not performed in an objective and accurate manner (Salas, Bowers & Cannon-Bowers, 1995; Salas, Morgan Glickman, 1987; Guerette *et al.*, 1987). Feedback is provided at the level of the individual trainee, rather than including the team aspects of the performance. Besides, both task-related and team-related feedback should be presented to the team members (Guerette *et al.*, 1987). Training assessment procedures for collecting team performance measurement data should be developed. Given that technological advanced learning environments are developed, the possibility of automatic team performance measurement (*i.e.* both collection and interpretation) is worthwhile to be explored (Salas & Cannon-Bowers, in press; Guerette *et al.*, 1987).

The cost-effectiveness of a training system is being neglected in many cases. But in times of decreasing (defense) budgets, detailed information on the costs of training and instruction must be made available to ensure cost effective training. This is especially the case when training devices are used that are relatively expensive to design and produce, such as software packages and simulators (Van Berlo, 1995). A problem in estimating the cost effectiveness of a training system is the difficulty of clearly defining the precise effects or benefits; *e.g.* it is impossible to transform these in monetary value only (Blomberg, 1989). Conducting a cost-effectiveness analysis regarding the development of team training systems is a largely unknown domain.

The guidelines previously discussed differ in comprehensiveness. Many aspects regarding the development of team training are being included, but a coherent set of guidelines is still missing. Also, the available guidelines are not exhaustive. Therefore, a consistent methodology for developing team training systems has to be developed, containing prescriptive guidelines for both instructional developers and instructors.

Finally, most of the guidelines and methodologies have not been tested empirically (Salas, Bowers & Cannon-Bowers, 1995), although this occurs more and more (*e.g.* Brannick *et al.*, 1995; Bowers, Baker & Salas, 1994; Fowlkes *et al.*, 1994). Yet, this point of critique is valid for training systems directed at individual trainees as well (*e.g.* Van Berlo, 1995; Gustafson, 1991; Andrews & Goodson, 1980). The refinement and validation of a team task analysis tool (see § 4.1) and the validation of team training strategies, especially in field settings, are critical endeavors that should be undertaken (Salas & Cannon-Bowers, in press).

6 FUTURE RESEARCH

In this report several guidelines for developing team training systems have been discussed. This inventory will be followed by a field study to investigate the way team training is being developed, conducted and evaluated in military and civil organizations. Instructional developers and team trainers will be interviewed. Topics that will be addressed are for instance: What general ISD-principles are being applied? How are team tasks being analyzed? How are training scenarios being developed? How is the structure of the training program developed? How is the team performance (both product and process) being measured? How is feedback being provided? How are the requirements for (technologically advanced) learning environments being specified? How is the role of the instructor being performed? Is instruction being differentiated towards the individual team members, and How is this being accomplished?
In addition to the interviews, actual trainings of teams will be attended and observed. Relevant issues during this part of the field study are for instance: are the guidelines provided by the instructional developers sufficiently specified for the instructor? how is being compensated for poorly defined guidelines? In cases where the instructional developer is the instructor as well, it is interesting to observe whether it is practiced what is preached.

The results of both the literature and field study will be analyzed and integrated into a prototype of a methodology for developing team training systems. Particular parts of this methodology that are insufficiently or ambiguously defined will be comprehensively delineated in guidelines. Future research will be aimed at developing the distinct guidelines comprising the methodology, and their empirical validation, so theory and practice mutually enhance each other (Salas, Cannon-Bowers & Blickensderfer, 1995b). Validating, for instance, guidelines supporting the analysis of a team task, can be done by specifying the skills required for a team task, formulating learning objectives, and developing a training program. Therefore, specific aspects regarding team training must be discussed more profoundly (*e.g.* designing training scenarios), or should be included in the discussion as well (*e.g.* providing feedback).

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APPENDIX A: The MAP system—A Job Analysis Taxonomy for Team Training (Source: Levine & Baker, 1991, p.15)

INDIVIDUAL TRAINING		
	from **experienced** team	from **inexperienced** team
	cell 1	cell 2
Interpersonal	D: 5, 9, 12, 13, 14 S: 4, 6 C: 2, 4 A: 4, 5, 6, 7	D: 5, 9, 12, 13 S: 2, 5, 6 C: 2, 3 A: 4, 5, 6, 7
	cell 3	cell 4
Production	D: 5, 7, 8, 12, 13 S: 4 C: 2, 4 A: 1, 2, 6, 7	D: 1, 3, 5, 6, 7, 12, 13, 14 S: 2, 3, 5, 6, 9 C: 1, 2, 3, 7, 8 A: 1, 2, 5, 6, 7, 9, 10
TEAM TRAINING		
	from **experienced** team	from **inexperienced** team
	cell 5	cell 6
Interpersonal	D: 3, 5, 9, 12, 13, 14 S: 2, 4, 5, 6 C: 2, 3 A: 4, 5, 6, 7	D: 3, 5, 9, 12, 13 S: 2, 3, 5, 6, 9 C: 2, 3 A: 4, 5, 6, 7
	cell 7	cell 8
Production	D: 3, 5, 7, 8, 12, 13, 14 S: 2, 3, 4, 6, 9 C: 2, 3 A: 4, 5, 6, 7	D: 1, 3, 5, 6, 7, 12, 13, 14 S: 2, 3, 5, 6, 9 C: 1, 2, 3, 7, 8 A: 1, 2, 5, 6, 7, 9, 10

D: job analysis descriptors
S: sources of data
C: methods of data collection
A: methods for analyzing data

APPENDIX B: The Teamwork Characteristics Checklist
(Source: Swezey, Llaneras & Salas, 1992, p.34/35)

1	Provides clear communication of team objectives to all team members.	□	0 1 2 3 4
2	Provides training on the team's organizational chain of command.	□	0 1 2 3 4
3	Provides training on the responsibilities of all team members.	□	0 1 2 3 4
4	Provides training on the responsibilities of all team leaders.	□	0 1 2 3 4
5	Specifies interdependencies in the performance of team activities.	□	0 1 2 3 4
6	Provides training on all team operations and tasks.	□	0 1 2 3 4
7	Provides training on how to maintain team leader effectiveness.	□	0 1 2 3 4
8	Includes performance aids or other adequate supplementary documentation on teamwork characteristics.	□	0 1 2 3 4
9	Provides criteria to use in evaluating mastery of teamwork skills and concepts.	□	0 1 2 3 4
10	Provides a way to identify areas where remediation is necessary.	□	0 1 2 3 4
11	Provides training on techniques to foster communication among team members.	□	0 1 2 3 4
12	Provides training on techniques to foster team performance coordination.	□	0 1 2 3 4
13	Provides training on techniques to foster shared attitudes among team members.	□	0 1 2 3 4
14	Provides training on techniques to foster respect for leadership and authority.	□	0 1 2 3 4
15	Provides generalized feedback on overall team performance.	□	0 1 2 3 4
16	Provides feedback to team members on their individual performance.	□	0 1 2 3 4
17	Provides opportunities to experience group interaction in performing team tasks.	□	0 1 2 3 4
18	Provides training in conditions which approximate the operational environment.	□	0 1 2 3 4
19	Provides examples of both acceptable and unacceptable team performance.	□	0 1 2 3 4
20	Provides for instructional sequencing based upon task complexity (simple tasks precede complex tasks).	□	0 1 2 3 4
21	Provides for instructional sequencing based upon increasing levels of teamwork.	□	0 1 2 3 4
22	Provides for team performance criteria which take into account changes in team member assignments.	□	0 1 2 3 4
23	Provides for team performance criteria which take into account the quality of team performance.	□	0 1 2 3 4
24	Provides for team performance criteria which take into account the effectiveness of individual team member's interpersonal skills.	□	0 1 2 3 4
25	Provides a means to communicate events which may cause special teams or subgroups to be disbanded.	□	0 1 2 3 4
26	Provides for periodic analyses of team training programs in terms of the adequacy of their instructional sequencing.	□	0 1 2 3 4
27	Provides for periodic analyses of team training programs in terms of the adequacy of their instructional methods.	□	0 1 2 3 4
28	Provides a means to cross-train individual team members across team tasks.	□	0 1 2 3 4
29	Provides for training team members to identify when the team leader is unable to lead.	□	0 1 2 3 4
30	Provides for training team members on how and when to assume a team leadership position.	□	0 1 2 3 4

The Instructional Characteristics Checklist
(Source: Swezey, Llaneras & Salas, 1992, p.35)

1	Provides for immediate feedback and knowledge of results to students.	□	0 1 2 3 4
2	Provides for positive forms of reinforcement.	□	0 1 2 3 4
3	Provides for negative forms of reinforcement.	□	0 1 2 3 4
4	Provides for variation of the amount of feedback during training stages.	□	0 1 2 3 4
5	Provides instructional techniques which can accommodate to different learning rates among students.	□	0 1 2 3 4
6	Provides instructional techniques which can accommodate to different styles of learning among students.	□	0 1 2 3 4
7	Provides instructional techniques which can accommodate to different levels of skill among students.	□	0 1 2 3 4
8	Provides for variation in the pace of training.	□	0 1 2 3 4
9	Provides for part-task training.	□	0 1 2 3 4
10	Provides for frequent and regular practice of learned skills.	□	0 1 2 3 4
11	Provides for administration of distributed practice.	□	0 1 2 3 4
12	Provides for immediate application of learned skills.	□	0 1 2 3 4
13	Includes a capability for presentation of graphics.	□	0 1 2 3 4
14	Includes a capability for presentation of sound.	□	0 1 2 3 4
15	Includes a capability for presentation of animation.	□	0 1 2 3 4
16	Allows for provision of incentives to students.	□	0 1 2 3 4
17	Provides for competition and challenge among students.	□	0 1 2 3 4
18	Includes a capability for active participation by students.	□	0 1 2 3 4
19	Provides for instruction which is related to past experiences of the students.	□	0 1 2 3 4
20	Provides for explicit communication of learning objectives to students.	□	0 1 2 3 4
21	Provides a capability for evaluation of pre-instructional knowledge and capabilities.	□	0 1 2 3 4
22	Provides adequate opportunities for students to acquire and store information.	□	0 1 2 3 4
23	Provides for gradual decreases in the use of learning aids.	□	0 1 2 3 4
24	Organizes instructional goals around clearly specified behavioral objectives.	□	0 1 2 3 4
25	Provides an overview of the instructional domain.	□	0 1 2 3 4
26	Provides for a correspondence between courseware/media and training objectives.	□	0 1 2 3 4
27	Provides for variability in content which approaches real-life situations.	□	0 1 2 3 4
28	Provides conditions which increase in similarity to the operational environment as training progresses.	□	0 1 2 3 4
29	Provides a capability for assessing the accuracy of student performance.	□	0 1 2 3 4
30	Clearly specifies requirements for advancement by students.	□	0 1 2 3 4
31	Provides warm-up exercises.	□	0 1 2 3 4
32	Provides sample items for use in self-evaluation by students.	□	0 1 2 3 4
33	Provides for built-in performance evaluations during the conduct of the training program.	□	0 1 2 3 4
34	Provides for frequent and regular testing.	□	0 1 2 3 4
35	Provides for session lengths which are within the attention span of the target audience.	□	0 1 2 3 4
36	Provides for generation of performance records which records acquired competencies.	□	0 1 2 3 4
37	Provides a capability for storage of performance records.	□	0 1 2 3 4
38	Provides an environment which allows for successful completion of all training objectives.	□	0 1 2 3 4
39	Provides for discrimination among situations which require student responses and those which do not.	□	0 1 2 3 4
40	Provides technically accurate instructional content.	□	0 1 2 3 4
41	Provides instruction based upon the minimal information necessary to accomplish training objectives.	□	0 1 2 3 4

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Systematic development of team training: A review of the literature

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A major drawback in the process of developing team training systems is that most methodologies and guidelines for developing training systems are aimed at the individual trainee. A coherent methodology for developing team training systems is still lacking. Consequently, developers of team training systems must often resort to the use of recommendations and guidelines geared to the development of individual-centered training systems. However, these may be insufficient given the different nature and characteristics of teams and team performance. Related to this point is the fact that, regarding complex learning environments developed for team training, it is often not clear which, and how, instructional principles should be applied to actually train the team.
In this report, the concept of team performance is being defined (chapter 2), preceded by an introduction in the first chapter. Chapter 3 concisely describes the four phases of instructional systems development, viz. analysis, design, implementation and evaluation. Based on these generic phases, in chapter 4 an overview is presented of various guidelines for developing team training as described in the literature. These guidelines (each referring to only some of the phases of instructional systems development) are being described and evaluated. On the basis of this review of the literature an inventory has been made regarding the aspects of team training development that remain to be analyzed (chapter 5). Finally, in chapter 6, the direction of future research is indicated.

16. DESCRIPTORS

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In zowel militaire als civiele organisaties worden veel taken eerder door teams dan door individuele functionarissen uitgevoerd. Ondanks het belang dat wordt gehecht aan team optreden worden slechts weinig inspanningen geleverd met betrekking tot het trainen van teams. Over het algemeen worden teams niet als zodanig getraind, met als argument dat het leren functioneren als een team het beste in de praktijk kan gebeuren. Ongevalsrapporten wijzen echter uit dat deze vorm van "team training op de werkplek" niet de meest effectieve en efficiënte manier is om teams voor te bereiden op de missies en taken die ze in de praktijk moeten uitvoeren.

Een tekortkoming in het proces van het ontwikkelen van trainingen is dat de meeste systematieken en richtlijnen primair zijn gericht op de individuele functionaris. Een systematiek specifiek gericht op teams ontbreekt vooralsnog. Het gevolg hiervan is dat opleidingsontwikkelaars van team trainingen beperkt ondersteund worden omdat de bestaande (op de individuele functionaris gerichte) systematieken onvoldoende de kenmerken van teams en team optreden verdisconteren. Dit heeft tot gevolg dat van bestaande leermiddelen die zijn ontworpen met als doel het trainen van team vaardigheden, het vaak niet duidelijk is welke onderwijskundige principes op welke manier toegepast moeten worden.

In dit rapport wordt, na de introductie in hoofdstuk 1, het begrip team optreden nader gedefinieerd (hoofdstuk 2). In hoofdstuk 3 wordt een korte omschrijving gegeven van de vier fasen van opleidingsontwikkeling, namelijk: analyse, ontwerp, implementatie en evaluatie. Aan de hand van deze algemene fasen wordt in hoofdstuk 4 een overzicht gegeven van verschillende richtlijnen voor het ontwikkelen van team trainingen zoals omschreven in de literatuur. Elk van deze richtlijnen (steeds met betrekking tot slechts een gedeelte van het totale proces van opleidingsontwikkeling, zoals b.v. het uitvoeren van een taakanalyse, het ontwikkelen van trainingsscenario's, het ontwerpen van een opleidingstraject) wordt beschreven en geëvalueerd. Op basis van deze literatuurstudie wordt geïnventariseerd welke aspecten van opleidingsontwikkeling ten behoeve van team training nog nader ingevuld moeten worden (hoofdstuk 5). Deze hebben met name betrekking op het uitvoeren van een analyse van een teamtaak, het ontwerpen van trainingsscenario's om teamleden in de gelegenheid te stellen de vereiste vaardigheden te leren en te oefenen, het toepassen van leerpsychologische en onderwijskundige principes bij het formuleren van (functionele) specificaties van geavanceerde leermiddelen, het vaststellen van de effectiviteit en efficiëntie van team trainingen, het empirisch valideren van de richtlijnen, en het integreren van de verschillende richtlijnen in één alomvattende systematiek voor het ontwikkelen van team trainingen. In hoofdstuk 6 tenslotte wordt aangegeven in welke richting het vervolgonderzoek zal worden uitgevoerd. In een veldonderzoek zal worden nagegaan door welke richtlijnen ontwikkelaars van team trainingen en instructeurs zich laten leiden. Op basis van zowel literatuur- als veldonderzoek wordt een prototype van een systematiek voor de ontwikkeling van team training vastgesteld. Voor specifieke onderdelen die onvoldoende of niet eenduidig gedefinieerd zijn, worden concrete richtlijnen geformuleerd die vervolgens empirisch getoetst zullen worden.